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SANDALWOOD OIL REQUIREMENTS.

By A. R. L. Dohme, and H. Engelhardt.

We have been studying East Indian sandalwood oil for many years, and since presenting our paper on the subject to the A.Ph.A. last year, we have continued the same and have come to some definite conclusions. We stated in our former paper[1] that many genuine East Indian sandalwood oils would not meet the requirements of the U.S.P., nor will they of the B.P. or any other pharmacopœia. Despite this fact there are genuine unadulterated sandalwood oils distilled properly from sound healthy logs grown in India, even in the Mysore district. The only conclusion to be drawn from this is that the U.S.P. requirements should be modified. In the U.S.P. requirements there occur at least four separate and distinct requirements that must be met to make a sandalwood oil entitled to the soubriquet "U.S.P." These are:

1. Specific gravity 0·965–0·975 at 25° C. (changed later to 0·965–0·980).

2. Angle of rotation upon polarized light should be not less than —16° nor more than —20° in 100 mm. tube at 25° C.

3. Soluble completely in 5 volumes of 70 per cent. alcohol.

4. Should contain not less than 90 per cent. of alcohols calculated as santalol.

As to which of these requirements is the most important a difference of opinion exists, but there should not, since a careful study of them all eliminates all of them but one as being crucial, decisive and reliable. We have found, as have other investigators,

[1] Proceedings A. Ph.A., 1906, or *American Druggist*, **49**, page 145.

that no definite relation exists between any two of these requirements, that all four of them vary widely, totally independently of one another; thus, an oil may contain 92 per cent. santalol and yet have specific gravity 0·963, be insoluble in 5 parts of 70 per cent. alcohol, and have rotation of —14° (see sample IV under first distillate in table below.)

The first criticism we have to make of the requirements is that a temperature should have been given for determining the solubility in 70 per cent. alcohol. It makes all the difference in the world if this is determined at 15°, 25° or 30° C. While it is understood perhaps that the temperature should be 25° C., this should have been stated just as much as it is stated for the specific gravity and rotation. We think the solubility should be taken at 30° C. rather than 25° C., as the latter temperature eliminates about 25 per cent. of oils that should be official, as they contain ample santalol and are not adulterated.

The second criticism is that the angle of rotation in the requirements is too high for the minimum limit and should be—12° to —20°; even then it will exclude many unadulterated, genuine, pure oils that are amply rich in santalol and hence amply efficient therepeutically (see samples IV and V of main distillate in table below.) Schimmel & Co.[1] state that they "consider the optical rotation and also the acid and ester numbers very useful factors in judging the oil." This is only true if you are looking for adulterations, when we grant that they will detect castor oil, rosin, etc. In our opinion, it is more important to have your requirements so that you do not exclude pure, efficient, genuine oil than have them so that to recognize adulterations you forsooth compel rejections of a genuine, Simon-pure product, containing over 90 per cent. of santalol, and hence therapeutically efficient. Both W. J. Bush & Co.[2] and Evans Sons, Loescher & Webb[3] find that the B.P. or U.S.P. requirements are so unjust that they prevent many genuine oils from being allowed to sail under the B.P. or U.S.P. flags, although they are in every way genuine and efficient. Bush & Co., express themselves forcibly on this subject and we agree with them fully—"It is obvious that the inclusion in the B.P. of such fallacious standards as those at

[1] Schimmel & Co., Semi-Annual Report, April, 1907, page 92.

[2] W. J. Bush & Co., *Chemist and Druggist*, 1907, Vol. LXXI, page 448.

[3] Analytical Notes, February, 1907, page 28.

present official defeats the object for which they are framed—namely, to ensure that only genuine, unmanipulated articles are offered for medicinal use. As they stand at present, they must have a directly opposite effect."

The real efficient and crucial test and requirement for the value and purity of a santal oil is the content of santalol, which is the efficient agent in the oil. As long, hence, as a santal oil contains at least 90 per cent. of santalol by assay, it matters little what the remaining 10 per cent. are, so long as they are obtained from sandalwood by distillation. The point we wish to make is that contrary to the views of Messrs. Schimmel & Co. we consider the optical rotation, acid and ester numbers as distinctly secondary in importance to the requirement of 90 per cent. santalol. Since our last publication, we have among others studied the distillation of oils from the following lots of santal oil imported by us from India direct:—

I. Seringapatam Panjam.
II. Sagar Banjam.
III. Chickmaglur Ghat Badala.
IV. Tarikere Ghat Badala.
V. Fraserpett Panjam.

Lot.	Specific Gravity.	Soluble in 70 per cent. alcohol.	αD. 25°.	Santalol. Per cent.	Acid number.
		FIRST DISTILLATE.			
I.	·951	Insoluble.	—15·7	77·7	2·06
II.	·962	"	—14·7	77·0	1·8
III.	·951	"	—18·1	70·0	2·7
IV.	·963	"	—14·0	92·0	·3
V.	·967	"	—14·0	82·4	—
		MAIN DISTILLATE.			
I.	·978	5	—12	89	·122
II.	·976	5·0	—11·8	93	1·1
III.	·975	3·75	—14·5	95	1·9
IV.	·979	Insoluble.	— 9·5	97·7	·25
V.	·978	6	—11	95·0	—
		LAST DISTILLATE.			
I.	·984	Insoluble.	—8	90	·124
II	·988	"	—9·2	—[1]	2·2
III.	·988	"	—4·2	—[1]	·4
IV.	·978	"	—5·7	90	·34
V.	·984	"	—10	90	·5

[1] The acetylized oil could not be separated, as it had almost the same specific gravity as water.

Some of the conclusions to be drawn from these results are:

(1) That the optical rotation as given in the U.S.P. is too high and should be changed to read —12° to —20° as in the main distillate, which makes up over 90 per cent. of the distillate, none of the products run anywhere near the limits of the U.S.P., although they are fully up to and most of them above the standard in santalol and in specific gravity, and two of them are all right in solubility. This almost proves, in our opinion, the fallacy of the optical rotation standard.

(2) That the solubility in 70 per cent. alcohol is not a safe criterion, since an oil that contains 95 per cent. of santalol (see lot V Main Distillate) still falls below the allowed standard, with a solubility of 1 to 6 instead of 1 to 5 volumes, and an oil (see lot IV Main Distillate) that runs as high as 97·7 per cent. santalol is insoluble in 5 volumes of 70 per cent. alcohol.

(3) That although all the acid numbers are low and show freedom from admixture of any adulteration, they serve no value as an indication of the quality of the oil; their purpose being, hence, only negative.

These results were obtained by distilling the sandalwood logs in at least 1,000 pounds lots in each case, and in most cases in much larger lots, so that the end product was a representative average product in each case. Although in all we tried about thirty varieties of wood from the most expensive to sandalwood sawdust, only about half of the oils obtained possessed an optical rotation high enough to pass U.S.P. requirements. Fully 90 per cent., however, passed muster as to specific gravity within the limits 0·965 to 0·980, as to solubility in 70 per cent. alcohol at 30° C. and percentage of santalol.

We also examined two samples of domestic santal oil from reputable firms bought on the open market and found that they both answered U.S.P. requirements, save the optical rotation, which in both cases was only —13°. Similarly W. J. Bush & Co.[1] found that of oils obtained from sixteen different parcels of genuine East Indian sandalwood only five gave a specific rotation higher than —16°, and they further state that this result confirms their previous experiences. Add to this the experience of Messrs. Evans Sons,

[1] *Loc. cit.*

Loescher & Webb,[1] that their oils have rotatory powers as low as —14·36° on the average, and we have, in our opinion, ample evidence to justify the lowering of the optical rotation of santal oil to —12° to —20°, and above all the passing of optical rotation as of crucial value in determining the value of santal oils. Let us take lots III First Distillate with specific gravity 0·951 insoluble in 70 per cent. alcohol, containing only 70 per cent. santalol, and hence to be rejected, as first distillates usually are, and yet this has an optical rotation of —18·1° higher than any other oil in above table, and should on this rotation be acceptable. Dozens of similar cases could be given to show the same thing, viz., an acceptable optical rotation for an inferior oil. Again, West Indian sandalwood oils or cedar-wood oil would be detected because they decrease the solubility in 70 per cent. alcohol or materially reduce the percentage of santalol in the oil. It might still be possible to make a sophisticated oil pass muster as to santalol percentage, provided the oil originally contained 98 per cent. santalol and were diluted with cedar-wood oil to reduce it to 90 per cent., but this could be detected by the solubility in 70 per cent. alcohol at 30° C., as it would not be soluble. In fine, in our opinion, the requirements calling for a content of 90 per cent. sanatol and a solubility of 5 volumes of 70 per cent. alcohol, at 30° C., and a specific gravity of 0·965 to 0·980 at 25° C., are ample to insure efficient santal oil to the buyer, and we would even dispense with the specific gravity and feel perfectly safe. We see no objection, further, to determining the acid number, as that will tell us at once if any fixed oil or rosin has been added as an adulterant.

COMPARATIVE COMPOSITION OF MILKS.

By Joseph W. England.[1]

On examining the chemical analyses of milk published, one is impressed with the enormous amount of work that has been done, and the apparent discrepancies in the results. These latter are due, partially, to technical difficulties in chemical analysis, but largely, to the fact that milk is an organized tissue, so to speak, as much so as blood, and that it varies in composition, not only during the act of nursing, but also, during the entire period of lactation.

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[1] From the Research Laboratory of Smith, Kline & French Co.

Hence, it has come to pass that widely varying results have been obtained by different workers. The chemical work was, in many instances, undoubtedly accurate, but the samples examined were not representative, and the deductions drawn not justified by the facts. Chemical data alone are not sufficient to properly interpret analytical findings, in the study of milk as a food; they must be accompanied by the consideration of physiological principles, also.

It has been with this thought in mind—the physiological chemical point of view, so to speak—that the writer has prepared the following chemical data, and endeavored to interpret their physiological significance.

PERCENTAGE COMPOSITION OF HUMAN MILK DURING THE ACT OF NURSING (FORSTER)

	First part of nursing act	Intermediate part of nursing act	Last part of nursing act
Fat.....	1.70	2.77	4.51
Proteids.....	1.13	0.94	0.71
Sugar.....	5.56	5.70	5.10
Ash	0.46	0.32	0.28
Water.....	90.24	89.68	87.50

Colostrum, the milk given by mammals for three or four days after the birth of their young, differs radically in composition from normal milk. It is a yellow, oily liquid of pungent taste, containing a very high percentage of an albumin similar to blood albumin, abundant fat globules, and numerous large circular cells called colostrum corpuscles.

According to Chapin, colostrum contains the same food elements as milk, but in different forms; its proteids are soluble, and its sugar dextrose, and not sugar of milk. Its function is to furnish readily-absorbable nutriment (since the stomach of the infant contains no gastric juice during the colostrum period) and to stimulate the development of the absorptive powers of the digestive tract.

The laxative action of colostrum in removing the meconium may be due, as Rotch claims, to a disturbance of the equilibrium of the mammary glands, and of the digestive tract of the infant, the disturbances in the latter amounting, at times, to acute conditions of fermentation in the intestinal tract, with laxation (a result facilitated by the presence of the readily fermentable sugar dextrose); but, it is much more probably due to the high percentage of fat in the fecal residue.

PERCENTAGE COMPOSITION OF COLOSTRUM

	Human (Pfeiffer) Average of 5 analyses; first three days	Cow (Engling) Average of 5 analyses; first three days
Fat	2.04	4.25
Proteids	5.71	Casein 3.60 Albumin 7.09
Sugar	3.74	2.97
Salts	0.28	Ash 1.10
Water	88.23	80.99

As shown above, the composition of human milk varies according to the time when it is drawn. The first portion suckled is rich in proteids and poor in fat. There is a physiological significance in this, the intent of nature obviously being that proteid-digestion shall precede fat-digestion, just as in adult digestion. "Gastric

PERCENTAGE COMPOSITION OF HUMAN MILK

Authority		Fat	Proteids	Sugar	Ash
Koenig, 200 samp's	Minimum	1.43	0.69 { A. 0.32 C. 0.18	3.88	0.12
	Maximum	6.83	4.70 { A. 2.36 C. 1.96	8.34	1.90
	Average	3.78	2.29 { A. 1.26 C. 1.03	6.21	0.31
			A-Albumin; C-Casein		
Leeds, (84 samples)	Minimum	2.11	0.85	5.40	0.13
	Maximum	6.89	4.86	7.92	0.37
	Average	4.13	2.00	6.94	0.20
Simon	14 samples, same woman	2.53	3.42	4.82	0.23
H. Gerber	6 samples, average	3.82	2.04	5.93	0.42
Marchand	Average	3.68	1.70	7.11	0.20
Clemm	12 days after delivery	3.34	2.91	3.15	0.19
Clemm	9 days after delivery	3.53	3.69	4.30	0.17
Clemm	4 days after delivery	4.30	3.53	4.11	0.21
Blyth	Average	2.90	3.07	5.87	0.16
J. Bell	Woman age 18 years	3.20	2.39	6.83	0.29
J. Bell	Woman age 33 years	2.99	2.51	6.51	0.30
Chevalier & Henry	Average	3.55	1.52	6.50	0.45
Hammarsten	Minimum	3.00	1.00	5.00	0.20
	Maximum	4.00	2.00	8.00	0.40
Mendel	Minimum	2.50	1.10	5.80	0.20
	Maximum	5.40	1.70	6.70	0.30
Babcock, Russell and Vivian	6 samples, different women				
	Minimum		1.68		
	Maximum		1.75		
Camerer and Soldner	Average	3.14	1.62	6.26	0.27
Backhaus	Average	3.50	1.75	6.20	0.25
Bunge	Average	3.80	1.70		0.20

juice does not act on fat, but, on the contrary, on fatty tissue, dissolving the cell membrane, and setting the fat free." (Hammarsten's Ph'y Chemistry, 1896, 166.) The percentage of sugar remains practically stationary, the sugar evidently not being an interfering factor in the digestion of proteids or fat.

To determine accurately the composition of human milk, a sample of the entire quantity from both breasts should be analyzed, which is rarely done; hence, to a degree, the widely varying results published of analyses of human milk.

PERCENTAGE COMPOSITION OF THE FATS OF MILKS

(Fats as Fatty Acid Glycerides, Olein, Palmitin, Stearin, etc.)

		Fat of Human Milk (Stern)			Fat of Cows' Milk (Brown)	
Volatile Fatty Acids	Acid Butyric,	$C_4H_8O_2$	1.4		5.45	8.35
	" Caproic,	$C_6H_{12}O_2$			2.09	
	" Caprylic,	$C_8H_{16}O_2$			0.49	
	" Capric,	$C_{10}H_{20}O_2$			0.32	
Non-Volatile Fatty Acids	Acid Lauric,	$C_{12}H_{24}O_2$	49.2		2.57	53.90
	" Myristic,	$C_{14}H_{28}O_2$			9.89	
	" Palmitic,	$C_{16}H_{32}O_2$			38.61	
	" Stearic,	$C_{18}H_{36}O_2$			1.83	
	" Dioxystearic,	$C_{18}H_{36}O_4$			1.00	
	" Oleic,	$C_{18}H_{34}O_2$	49.4			32.50

Fat of Human Milk.—Very small amount of volatile fatty acids; oleic acid forms, practically, one-half of the non-volatile acids; of the solid fats, myristic and palmitic acids occur in larger amounts than stearic acid.

Fat of Cow's Milk.—Volatile fatty acids, about six times that of human milk; oleic acid constitutes nearly one-third of the non-volatile acids; of the solid fats, palmitic and stearic acids predominate.

The "rancidity" of milk-fat (butter) is due to the oxidation of the glycerides of the volatile fatty acids.

The fat of human milk is always incompletely absorbed by the infant economy, the fat content of dry feces ranging between 10 and 20 per cent. The younger the infant the larger the amount of unabsorbed fat. "During the first week of life the dried feces contain (Die Faeces. Schmidt and Strasberger, 1903; by Blauberg) 40 per

cent. of fat when mother's milk, and fully 50 per cent. when cow's milk has been ingested (the moist feces contain, of course, less fat—J. W. E.). The function of the fecal fat is probably to protect the mucous surfaces of the intestinal tract, and to facilitate the expulsion of the feces." ("The Fat Question in its Relation to the Production and Cure of Infantile Marasmus," by Heinrich Stern, *Arch. of Ped.*, 1905, 431.)

PERCENTAGE COMPOSITION OF THE SALTS OF MILKS

	Human Milk Harrington and Kinnicutt, quoted by Rotch	Cow's Milk Soldner, quoted by Leach
Sodium Chloride, NaCl	21.77	10.62
Potassium Chloride, KCl	12.05	9.16
Mono-potassium Phosphate, KH_2PO_4		12.77
Di-potassium Phosphate, K_2HPO_4		9.22
Potassium Citrate, $K_3C_6H_5O_7$		5.47
Di-magnesium Phosphate, $MgHPO_4$		3.71
Magnesium Citrate, $Mg_3(C_6H_5O_7)_2$		4.05
Di-calcium Phosphate, $CaHPO_4$	Calcium Phosphate	7.42
Tri-calcium Phosphate, $Ca_3(PO_4)_2$	23.87	8.90
Calcium Citrate, $Ca_3(C_6H_5O_7)_2$		23.55
Lime combined with proteids		5.13
Calcium Silicate, $CaSiO_3$	1.27	
Calcium Sulphate, $CaSO_4$	2.25	
Calcium Carbonate, $CaCO_3$	2.85	
Magnesium Carbonate, $MgCO_3$	3.77	
Potassium Carbonate, K_2CO_3	23.47	
Potassium Sulphate, K_2SO_4	8.33	
Iron Oxide and Alumina	0.37	
	100.00	100.00

Rotch gives an analysis of the ash of human milk (six quart sample) by Harrington and Kinnicutt, and a statement expressing an approximation to the relative proportions of salts *in the form in which they occur in milk* (as stated above), but it is very obvious that the conclusions from the analysis are practically valueless, because no account whatever was taken of the organic matter present in the salts of the milk.

As Soldner has shown, nearly one-third of the salts of cow's milk are alkali-citrates and alkali-earth citrates, and, as Leffmann states "Citric acid (as citrates) is a normal constituent of the milk of various animals. In human milk the quantity is about 0·5 gramme to the liter; in cow's milk, from 1 to 1·5 grammes. It is not dependent upon the citric acid present in the food."

Harrington and Kinnicutt themselves obtained, as they report, 7 97 per cent. of carbonic acid gas after incinerating the salts of human milk, and yet no statement is made of the presence of any organic acid salts.

With reference to the Soldner analysis, it should be noted that while the citrates embrace one-third of the salts, the chlorides approximate nearly one-fifth, and the phosphates nearly one-half. The ash of the milk does not represent the salts of milk in the form in which they occur in milk; it represents only the incinerated salts, the incineration destroying all organic matter and altering the chemical form of the salt.

PERCENTAGE COMPOSITION OF COWS' MILK DURING THE PERIOD OF LACTATION. (Farrington, quoted by Chapin)

	Number of Samples	Fat	Proteids
Holstein Cow	278	Minimum, 1.50 Maximum, 6.60	Minimum, 2.64 Maximum, 4.11
Short Horn Cow	428	Minimum, 2.50 Maximum, 7.90	Minimum, 2.92 Maximum, 3.89
Jersey Cow	614	Minimum, 2.90 Maximum,12.30	Minimum, 2.98 Maximum, 5.30

Cow's milk, like human milk, varies in composition during the act of suckling or milking. Thus, as Leach reports, the "fore-milk" of cows contains from 1·07 to 1·32 per cent. of fat, and the "strippings" from 9·63 to 10·36 per cent. of fat, while the non-fatty solids range in the "fore-milk" from 10·20 to 10·51 per cent., and in the "strippings" from 9·27 to 9·55 per cent.

It should be observed also, as Farrington shows, that cow's milk varies in composition during the period of lactation, and the milk of a mixed herd is, therefore, much more uniform than the milk of a single cow, because the milk of cows for calves of different ages is mixed, and the minimum and maximum percentages, due to the individual factor, are equalized. And so, when large numbers of analyses are added together and averaged, the individual differences, which are sometimes extreme, become equalized in the general averages.

PERCENTAGE COMPOSITION OF COWS' MILK

Authority		Fat	Proteids	Sugar	Ash
Koenig, (800 samples)..	Minimum	1.67	2.07 { A. 0.25 C. 1.79	2.11	0.35
	Maximum	6.47	6.40 { A. 1.44 C. 6.29	6.12	1.21
	Average	3.64	3.55 { A. 0.53 C. 3.02	4.88	0.71
			A-Albumin; C-Casein		
Babcock	Average	3.60	3.80	4.50	0.70
Hutchison	Average	3.50	3.00	4.00	0.70
		-4.50	-4.00	-5.00	
N. Y. Experiment Station, (Chapin).....	Holsteins	3.46	3.39	4.84	0.74
	Jerseys	5.61	3.91	5.15	0.74
	Average Herd	4.00	3.50	4.50	0.75
Rotch.....	Durham	4.04	4.17	4.34	0.73
	Devon	4.09	4.04	4.32	0.76
	Ayrshire	3.89	4.01	4.41	0.73
	Holstein-Friesian	2.88	3.99	4.33	0.74
	Brown-Swiss	4.00	4.00	4.30	0.76
N. J. Agricultural Station, (Bulletin 77, 1890).....	Ayrshire	3.68	3.48	4.84	0.69
	Guernsey	5.02	3.92	4.80	0.75
	Holstein-Friesian	3.51	3.28	4.69	0.64
	Jersey	4.78	3.96	4.85	0.75
	Short-Horn	3.65	3.27	4.80	0.78
American Experimental Station Record (v. No. 10, p. 945)...					
(238 samples)	Jersey	5.61	3.91	5.15	0.743
(112 samples)	Guernsey	5.12	3.61	5.11	0.753
(72 samples)	Devon	4.15	3.76	5.07	0.760
(252 samples).....	Ayrshire	3.57	3.43	5.33	0.698
(124 samples)	American-Holderness	3.55	3.39	5.01	0.698
(132 samples)	Holstein-Friesian	3.46	3.39	4.84	0.735

PERCENTAGE COMPOSITION OF COWS' MILK
(VIETH & RICHMOND). (Allen's Organic Chemistry 4, 122)

Year	Number of Samples	Specific Gravity at 15° C.	Total Solids	Fat	Solids Not Fat	Analyst
1881.....	6,592	1.0315	12.80	4.12	8.68	P. Vieth
1882.....	9,190	1.0319	13.03	4.22	8.81	"
1883.....	9,650	1.0323	12.97	4.10	8.87	"
1884.....	10,399	1.0323	12.96	4.08	8.88	"
1885.....	11,389	1.0322	13.06	4.19	8.87	"
1886.....	12,181	1.0322	12.92	4.07	3.85	"
1887.....	12,663	1.0322	12.94	4.07	8.87	"
1888.....	12,682	1.0323	12.94	4.06	8.88	"
1889.....	12,617	1.0321	12.83	4.01	8.82	"
1890.....	11,816	1.0322	12.84	4.00	8.84	"
1891.....	11,361	1.0322	12.76	3.91	8.85	"
1892.....	13,196	1.0320	12.71	3.91	8.80	H. D. Richmond
1893.....	14,643	1.0318	12.68	3.91	8.77	"
1894.....	12,633	1.0322	12.67	3.86	8.81	"
1895.....	11,081	1.0322	12.66	3.84	8.82	"
Average	172,093	1.03215	12.86	4.02	8.84	

While there is a marked difference in the fat-percentage of the milks of different breeds of cows, and in individuals of the same breed, there is a fairly uniform difference in the averages of several individuals. "It is largely owing to this influence that we find the milk of one country differing from that of another, or the milk of one section of the country differing from that of another section. For example, the average amount of fat in milk in Germany and Holland is fully one-half per cent. lower than in this country, because the prevailing breeds there are those producing milk comparatively low in fat." (Modern Methods of Testing Milk and Milk Products, L. L. VanSlyke, 1907, 6.)

COMPARATIVE COMPOSITION OF HUMAN MILK AND COWS' MILK

(At Intermediate Period of Lactation)

	Human Milk			Cows' Milk	
Glycerides of the non-volatile fatty acids	Olein	2.00	4.00 (Fat)	1.40	4.00 (Fat)
	Palmitin, Stearin, Dioxystearin, Laurin, Myristin	2.00		2.25	
Glycerides of the volatile fatty acids	Butyrin, Caproin, Caprylin, Caprin	trace		0.35	
Proteids	Casein	0.75	1.75	3.00	3.50
	Albumin	1.00		0.50	
	Opalisin	trace		trace	
	Globulin	trace		trace	
	Galactin			trace	
	Fibrin			trace	
Milk Sugar		6.50			4.50
Citric Acid (as Citrates)		(0.05) trace		(0.125)	trace
Salts		0.25			0.75
Total Solids		12.50			12.75
Water		87.50			87.25
		100.00			100.00

American pediatrists generally accept the following standard of percentages for human milk: Fat, 3 to 5 per cent.; proteids, 1 to 2 per cent., and sugar, 6 to 7 per cent., the average being, fat, 4 per cent.; proteids, 1:5 per cent., and sugar, 7 per cent. The data, submitted, however, would seem to indicate that, generally, at the inter-

mediate period of lactation, at least, the fat is nearer 4 per cent. than 3, the proteids nearer 2 per cent. than 1, and the sugar between 6 per cent. and 7, or a ratio of 4, 1·75 and 6·50.

As to the standard of percentages for cow's milk, American pediatrists generally accept the following: Fat, 4 per cent.; proteids, 3·5 per cent., and sugar, 4·5 per cent., though for the purpose of ready calculation, it is often assumed that cow's milk contains fat, 4 per cent.; proteids, 4 per cent., and sugar, 4 per cent.

PERCENTAGE COMPOSITION OF VARIOUS MILKS

(From Koenig's Chemie der mens. Nahr. u. Genuss.; by Leach)

		Fat	Proteids		Sugar	Ash
Goat's Milk, 200 samples....	Minimum	3.10	3.22	A. 0.78 C. 2.44	3.26	0.39
	Maximum	7.55	5.95	A. 2.01 C. 3.94	5.77	1.06
	Mean	4.78	4.29	A. 1.09 C. 3.20	4.46	0.76
Ewe's Milk, 32 samples....	Minimum	2.81	4.42	A. 0.83 C. 3.59	2.76	0.13
	Maximum	9.80	7.46	A. 1.77 C. 5.69	7.95	1.72
	Mean	6.86	6.52	A. 1.55 C. 4.97	4.91	0.89
Mare's Milk, 47 samples....	Mean	1.21	1.99	A. 0.75 C. 1.24	5.67	0.35
Ass's Milk, 5 samples.....	Mean	1.64	2.22	A. 1.55 C. 0.67	5.99	0.51

A word or two should be said with reference to the subject of the proteids of milks. These are almost wholly casein and albumin. The milks of those animals whose digestion is principally gastric, contain, in their total proteids, a much larger proportion of casein to albumin, than do the milks of those animals whose digestion is principally intestinal. Thus, Koenig's analyses show that in the *mean*, of the minimum and maximum percentages of cow's milk, the ratio of casein to albumin is about 6 to 1, in goat's milk 3 to 1, and in sheep's milk 3 to 1, while in mare's milk it is 1·5 to 1, and

in ass's milk 1 to 2·3. Human milk is intermediate, being nearly 1 to 1. It is important to note, also, that the maximum ratio of casein to albumin in cow's milk is about 7 to 1, and the minimum 4·5 to 1; the maximum of goat's milk is 3 to 1, and the minimum 2 to 1; and the maximum of sheep's milk is 4 to 1, and the minimum 3 to 1.

These variations in the ratios of casein to albumin in the milks of different animals are not accidents of nature. They are in direct obedience to the law of supply and demand. They mean simply that the proportion of food-material that is digested with difficulty (casein) to the food-material that is digested with ease (albumin), is adjusted by nature to meet the needs of the individual animal for the proper development of the motor and chemical functions of its stomach and intestines. Naturally, with the larger animals, more casein and less albumin is required, than with the smaller animals. So far as the food-value of the two proteids to the body is concerned, they are probably of equal value. Not only does the ratio vary with different animals, but in the same animals of the same age, in obedience to individual needs, though the latter variations are within much narrower limits than the former. A sixteen pound infant, for example, requires more casein than a twelve pound one, though both may be six months of age. Hence, it follows that human milk is a food of constantly changing composition. At birth much albumin, and little casein is needed, and then as the child grows and develops, more and more casein is required, and less and less albumin.

As to the chemical reactions of milks with gastric juice, the formation of curds, the kinds of curds, and the functions of curds, and the mechanical and chemical modifications of curds—these are questions of the deepest scientific interest to the pediatrist, but wholly outside the province of this paper.

The composition of cream varies greatly according to the method used in obtaining it. It is obtained (1) by setting milk in shallow pans and removing the cream by hand-skimming, or (2) by placing it in deep vessels surrounded by cold water, the skimmed milk being drawn off from below (both of these are gravity creams), or (3) by means of the centrifugal separator. The United States standard for cream (U. S. Dept. of Agri., Office of Sec., Cir. 10) is 13 per cent. milk fat.

PERCENTAGE COMPOSITION OF CREAM

Authority		Fat	Proteids	Sugar	Ash
Gravity Cream; Koenig, (46 samples)	Average	22.66	3.76	4.23	0.53
Centrifugal Cream, Heavy; Leach, (18 samples)	Minimum	38.10			
	Maximum	46.40			
	Average	42.02			
Centrifugal Cream, Light; Leach, (18 samples)	Minimum	8.60			
	Maximum	21.60			
	Average	13.86			
Centrifugal Cream (from Milk 4.00, 3.50, 4.50)					
Centrifugal Cream, (8%) Holt.		8.00	3.40	4.50	
Centrifugal Cream, (12%) Holt.		12.00	3.30	4.20	
Centrifugal Cream, (16%) Holt.		16.00	3.20	4.05	
Centrifugal Cream, (20%) Holt.		20.00	3.05	3.90	
Centrifugal Cream, (40%) Holt.		40.00	2.20	3.00	
New York Creams, Holt		8-40			
Very Rich Centrifugal Cream, Holt		35-40			
Ordinary Centrifugal Cream, Holt		18-20			
Gravity Cream, Holt		16-20			

Skimmed milk is essentially whole milk with the larger part of its fat removed. By separation with shallow pans the fat content is from 0·54 to 1·co per cent.; with deep pans, from 0·43 to 1·05 per cent., and with the modern centrifugal separators, from 0·10 to 0·25 per cent. (Vieth; quoted by Allen.)

PERCENTAGE OF FAT IN TOP MILKS FROM QUART BOTTLES

	Sherman, quoted by Winters	Chapin (Fat of Whole Milk, 4.1%)	Chapin (Fat of Whole Milk, 3.1%)	England and La Wall
½ ounce	24.80			24.00
1 "	23.10			22.00
2 "	21.40	24.00		21.75
3 "		22.50		
4 "	20.10	21.40		18.80
5 "		19.20		15.80
6 "	18.60	16.80	13.40	
7 "		15.00	11.60	
8 "	16.70	13.30	10.20	13·20
9 "		11.50	9.20	
10 "		10.50	8.40	
12 "	12.10	9.00	7.10	9.60
14 "		7.80	6.20	
16 "	9.40	7.00	5.50	7.00
18 "		6.30		
20 "		5.80		
22 "		5.40		
24 "		5.00		
26 "		4.70		
30 "		4.30		
32 "		4.10	3.10	4.30

Top milks are the upper portions of a quart bottle of cow's milk that has stood in a cool place until a creamy layer has formed. They are obtained with the use of the tin or aluminum dipper devised by Chapin. The dipper, which holds 1 fluidounce, is gently immersed in the liquid, filled, removed, and the contents emptied into another vessel and mixed. The first two dippings, mixed, constitutes 2-ounce top milk; or the first four dippings, 4-ounce top milk, or the first eight dippings 8-ounce top milk, etc. Little or no disturbance of the different layers of the liquid results from the act of dipping. The creamy layer usually constitutes about 5 or 6 fluidounces, varying according to the original fat percentage of the milk, and the length of time standing. It includes, practically, all the fat of the milk. Eight-ounce top milk, or over, contains not only the cream, but some nearly fat-free milk, also.

The top-milk system of infant feeding is rapidly coming into medical favor. By diluting top milks with water, or with water and whole milk, it is possible to obtain mixtures for infant feeding that contain a higher percentage of fat with a normal percentage of proteid, than is possible to obtain with any dilutions of cow's milk.

The top milks are much superior to creams, not only because the fat percentages are more uniform, but also, what is equally or more important, the dilutions (especially those made with whole milk and water) do not readily separate on standing into strata of differing fat-percentages. Infants fed with stratified mixtures are fed an excessive amount of fat in the first portions of the food, which is just the reverse of what obtains in the feeding of human milk. Stratification is especially liable to occur with the centrifuge creams, as these, during the process of centrifuging, are partially disorganized, and hence, mixed with water, readily stratify.

RECENT PROGRESS IN THE CHEMISTRY OF ALKALOID ESTIMATIONS.[1]

By W. A. Puckner.

While chemistry ranks as a science, analytical chemistry is often spoken of as the "art of analysis." And this with some justice, for the attention to details which a successful analysis makes

[1] Read before the Philadelphia Branch of the American Pharmaceutical Association, January 7, 1908.

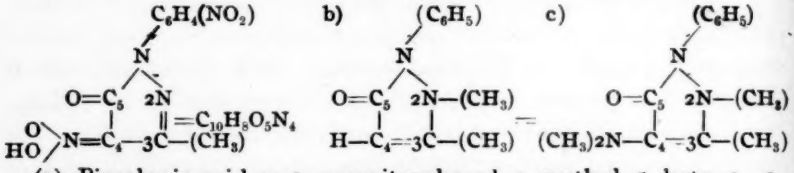
necessary requires the deft touch, the accurate eye, and the patient mind of an artist. Especially does the elaboration of new and more exact methods of estimating the alkaloid content of vegetable drugs and pharmaceutical preparations require much attention to detail. So much experimentation of an apparently empirical character must be done that the scientific nature of such investigations is not always evident. To emphasize that analytical chemistry employs the same fundamental conceptions and facts that are used in other branches of chemical research some recent progress in the estimation of alkaloids may be of interest. The writer therefore begs to present, divested of all analytical detail, some of the advances made in recent years in this important field of research.

Alkaloidal Precipitants.—Some fifteen or twenty years ago, especially in the United States, the standard method of estimating alkaloids in drugs and pharmaceutical preparations was based on their precipitation with a standard solution of potassium mercuric iodide, commonly known as Mayer's solution. The precipitates which alkaloids formed with this reagent were supposed to be definite compounds of alkaloid iodide with mercuric iodide containing for every molecule of mercuric iodide one, two or three molecules of alkaloid iodide. Attempts were made to determine for each alkaloid the composition of the precipitate obtained and to calculate from the volume of Mayer's solution used in each case the amount of alkaloid present. That the composition of these alkaloidal precipitates was variable and that the amount of alkaloid could not directly be calculated from the volume of Mayer's solution used was soon demonstrated, especially by A. B. Lyons and A. B. Prescott. To-day this method of estimating alkaloids is almost forgotten. Only occasionally is reference made to it—as was recently done when Lyons, at a meeting of the American Pharmaceutical Association, stated that, in his opinion, it should still be given preference in the valuation of ipecac.

Ten to fifteen years ago the estimation of alkaloids by means of iodine solution (Wagner's reagent) was proposed by Kippenberger in Germany and by Prescott, Gordin and Gomberg in this country. But, again, while at first the periodides were supposed to be definite in composition it was soon found that the composition of these precipitates, consisting of alkaloid iodide plus iodine, and corresponding to the composition of the potassium compound contained in Lugoll's

solution—that is potassium iodide plus iodine—was in most cases variable and depended upon conditions of concentration, etc. To-day this method of estimating alkaloids by the amount of iodine consumed in their precipitation is rarely mentioned.

The fact that these general alkaloidal precipitants, while valuable in the detection and the isolation of alkaloids, are no longer used for their quantitative determination, makes of especial interest the recent publications in regard to a new precipitant which is claimed to form very insoluble compounds of definite composition with nearly all alkaloids. The reagent has been called picrolonic acid from the fact that its behavior with alkaloids closely corresponds to that of trinitrophenol or picric acid. It was first investigated by Knorr, the discoverer of antipyrin. The following structural formulas indicate its relationship to antipyrin and pyramidon:



(a) Picrolonic acid or 1–paranitrophenyl–3–methyl–5 keto–1, 2–diazol–4–nitric acid;

or 1–paranitrophenyl–3–methyl–pyrazolon–nitric acid.

(b) Antipyrin or 1–phenyl, 2, 3–dimethyl, 5–keto, 1, 2–diazol or 1–phenyl, 2, 3–dimethyl–pyrazolon.

(c) Pyramidon or 1–phenyl, 2, 3–dimethyl, 4–dimethylamino–5–keto,–1, 2 diazol;

or 1–phenyl, 2, 3–dimethyl, 4–dimethylamino–pyrazolon.

The substance may be looked upon as a nitrate in which one oxygen atom of nitric acid has been replaced by the organic radicle. If this is done its behavior with alkaloids is evident.

Just as ammonia combines with nitric acid to form ammonium nitrate, or, in accordance with present theories of chemistry, just as ammonia combines with water to form ammonium hydroxide and ammonium hydroxide reacts with hydrogen nitrate to form ammonium nitrate and water, thus:

$$NH_3 + HNO_3 = NH_3.HNO_3;$$
$$\text{or } NH_3 + H_2O = NH_4OH$$
$$NH_4OH + HNO_3 = NH_4NO_3 + H_2O.$$

And just as morphine combines with nitric acid to form morphine nitrate, or, more correctly, as the free base morphia reacts with water to form morphium hydroxide, and as morphium hydroxide reacts with hydrogen nitrate to form morphium nitrate and water, thus:

$$C_{17}H_{19}O_3N + HNO_3 = C_{17}H_{19}O_3N.HNO_3$$

morphine;

or $C_{17}H_{19}O_3N + H_2O = C_{17}H_{20}O_3N.OH$

$C_{17}H_{30}O_3N.OH + HNO_3 = C_{17}H_{20}O_3N.NO_3 + H_2O$

So, in the same way, morphine combines with picrolonic acid to form morphine picrolonate, or, more correctly, morphia combines with water to form morphium hydroxide, and this morphium hydroxide then reacts with hydrogen picrolonate to form morphium picrolonate and water, thus:

$$C_{17}H_{19}O_3N + HN(C_{10}H_7O_3N_3)O_2 = C_{17}H_{19}O_3N . HN(C_{10}H_7O_5N_3)O_2$$

morphine picrolonic acid;

or $C_{17}H_{19}O_3N + H_2O = C_{17}H_{20}O_3N.OH$

$C_{17}H_{20}O_3N.OH + HN(C_{10}H_7O_5N_3)O_2 =$

$C_{17}H_{20}O_3N.N.(C_{10}H_7O_5N_3)O_2 + H_2O.$

A considerable number of investigations of the composition of the precipitants which alkaloids form when treated with this reagent have been made. Especially have H. Mathes and O. Rammstedt at the University of Jena studied the value of this reagent for the valuation of vegetable drugs. Beyond the claim that the composition of these precipitates is constant and exceedingly insoluble, the reagent is claimed to be of special value because of the high melting point of the precipitate, which melting point therefore may be taken as a proof of the identity and the purity of the alkaloidal precipitate.

Another reagent, the adaptability of which has been studied in recent years, is a solution of potassium bismuth iodide. Just as potassium iodide forms a double compound with bismuth iodide so alkaloids react to form the alkaloid bismuth iodides. And just as the compounds which potassium iodide forms with bismuth iodide are of a variable composition so the alkaloid bismuth-iodides are variable and this reagent has been used only as a means of separat-

ing alkaloids from other bodies and not as a means of directly estimating them.

As reagents which have been used for the precipitation of certain alkaloids the following may be mentioned: It has been proposed to precipitate quinine by means of ammonium sulphocyanide in presence of a zinc salt and the precipitate under definite conditions is claimed to have a constant composition—viz., 4 molecules of quinine, + 3 molecules zinc sulphocyanide, + 2 molecules ammonium sulphocyanide, + 4 molecules hydrogen sulphocyanide. While quinine oxalate is insoluble in ether, the remaining oxalates of the cinchona alkaloids are soluble in ether. It is therefore proposed to obtain an etheral solution of the cinchona alkaloids and to determine by titration with the standard etheral solution of oxalic acid the amount of total alkaloids contained in the drug and to collect and weigh the insoluble quinine oxalate.

The Solubility of Alkaloids in Immiscible Solvents and the Hydrolysis of Alkaloid Salts.—At the present time nearly all estimations of alkaloids in vegetable drugs and their preparations are based upon two properties of alkaloids—viz., free alkaloids are generally insoluble in water but soluble in chloroform, ether and similar solvents, while the alkaloid salts are soluble in water but insoluble in ether, chloroform, etc. To this general ruling a few exceptions have been generally recognized. Thus, it is well known that caffeine and colchicine can be extracted from acid solutions by means of chloroform. It is generally said that these alkaloids are too weak to form salts, although a more correct explanation would be to say that, while these alkaloids do form well defined salts, these compounds are decomposed by water (hydrolyzed) to such an extent that the free alkaloid may be extracted from acid solution by means of ether or chloroform. Just as we have inorganic salts that are very largely, very slightly or practically not at all decomposed by water (hydrolyzed), so with alkaloids, all gradations of hydrolysis are known. This has been studied quite extensively within recent years, especially by C. Kippenberger and Professor Edward Schaer, of the University of Strasburg, and his students. These experiments have shown that in the presence of a considerable excess of the strong acids the hydrolysis of most alkaloid salts is slight so that no alkaloid is extracted when such a solution is shaken with chloroform or ether. When weak acids are used, such as phosphoric

and tartaric, or when only sufficient strong acid is present to just neutralize the alkaloid, extraction with chloroform will remove an appreciable amount of alkaloid from its aqueous solutions.

It has also been shown that many alkaloidal salts, as such, are soluble in chloroform, especially the salts of hydrochloric and hydrobromic acid. The alkaloid sulphates were not found to be appreciably soluble in chloroform or ether.

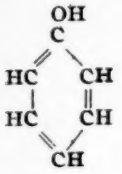
The practical lesson to be drawn from this is that, in the estimation of alkaloids, sulphuric acid should be given preference whenever possible. This is especially true when in forensic estimations small amounts of alkaloids are to be detected. Where tartaric or phosphoric acid is now generally used, sulphuric acid should be given the preference.

Interference of Ammonia, Volatile Bases and Fats in the Estimation of Alkaloids.—It was first pointed out, especially by Professor Thoms, that drugs—particularly leaf drugs—contain volatile bodies of alkaline reaction. These in some cases are ammonium salts; in other cases they are volatile amines. To this factor are due the variable results formerly reported for the mydriatic drugs, especially henbane, and which are still obtained with methods such as those of the German pharmacopœia, in which the volatile bases, or ammonium hydroxide, whichever is present in the drug, is carried over into the ether used to extract the drug. Although it is directed that a portion of this ether be distilled off before the remaining etheral fluid is titrated for its alkaloid content, yet these methods often give high results because the volatile bases are not completely eliminated. In some cases even, where a complete evaporation of the ether is directed, high results are obtained unless special precautions are taken to insure the complete evaporation of the volatile basic bodies. Several attempts have been made to eliminate errors of this kind. Thoms precipitates with potassium bismuth iodide, which reagent precipitates the vegetable bodies commonly classed as alkaloids and eliminates the volatile organic bases, ammonium salts and free ammonia. Another way of eliminating this error, at least in so far as it is due to the presence or formation of ammonium hydroxide, has recently been proposed by H. M. Webster. Webster finds that while alkaloid-hydrogen tartrates are quite insoluble in alcohol, just as are ammonium-hydrogen tartrate and potassium-hydrogen tartrate, the alkaloid-hydrogen tartrates

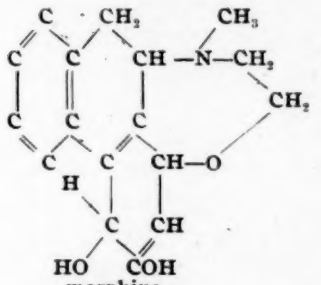
differ in that they dissolve when more tartaric acid is added. Upon this fact is based the elimination of ammonium compounds in the estimation of alkaloids. Finally, Fromme has claimed that fats and waxes may interfere in the estimation of alkaloids; thus, when a drug is treated with ammonia water and ether, the fat contained in the drug is converted to soap by the alkali used and passes into the etheral solution. If in this etheral solution the alkaloid is estimated with standard acid a part of the acid will be used to decompose the soap, but will be calculated as having been used to neutralize alkaloid.

Decomposition of Chloroform by Alkaloids.—Recently A. Panchaud reported that cinchona alkaloids readily decompose chloroform with formation of hydrogen chloride. He reported that in the assay of cinchona the extracted cinchona alkaloids were dissolved in chloroform one evening, and when these were titrated, the following morning, from 20 to 100 per cent. of the alkaloid was found to have been neutralized by the hydrogen chloride produced in the decomposition of the chloroform. Since the decomposition of ·0229 gramme chloroform will yield an amount of hydrochloric acid sufficient to neutralize ·120 gramme alkaloid, the possible error is obvious. A. Simmer, working at the University of Strasburg under Professor Schaer, has studied this question in detail and has not confirmed Panchaud's results. While he found that a number of alkaloids do decompose chloroform with formation of chloride the amount of chloroform so decomposed is slight, even when the alkaloids are in contact with the chloroform for a prolonged time and when the chloroform is heated to boiling. The danger of error in the estimation of alkaloids due to the decomposition of chloroform therefore does not appear to be very great, but the report of Panchaud nevertheless remains that chloroform is a body easily decomposed, especially by alkaline substances.

Morphine a Phenol.—In the present United States Pharmacopœia the purity of morphine, obtained in the assay of opium and its preparations, is judged by its solubility in lime water. This test is based on the phenolic character of morphine. That is, the morphine molecule contains two hydroxyl groups, one of which is of the same character as the hydroxyl group in phenol (carbolic acid), thus:



phenol.



morphine.

This "phenolic hydroxyl" gives to morphine the many properties of a phenol, such as the coloration produced by ferric salts, its reducing effects on iron and on iodates, which reactions permit the ready distinction of morphine from codeine, dionin (ethyl morphine) and heroin (diacetyl morphine hydrochloride), in which the phenol group has been replaced and which therefore no longer give the reactions of a phenol. When morphine dissolves in lime water, it again shows phenolic character. That is, phenols in general are dissolved by strong bases with formation of phenolates. It may not be out of place to recall that upon this phenolic character also depends one of the difficulties in the valuation of opium; that is, while morphine is precipitated from its solution as the insoluble morphine by means of ammonium hydroxide, a large excess of this base must be carefully avoided since by it morphine is re-dissolved to a considerable extent with formation of ammonium morphinate.

Separation of Strychnine from Brucine.—In 1889 Gerock first proposed a method of separating strychnine from brucine based on the ease with which brucine is oxidized by nitric acid and the relative resistance of strychnine to such oxidation. Since then many modifications of this method have been proposed. A modification proposed by Gordin has been made official in the United States Pharmacopœia. Largely because of this, the process of estimating strychnine has lately again been studied by chemists.

At a recent meeting of the American Pharmaceutical Association, where the assay methods of the new Pharmacopœia were discussed, J. M. Francis remarked that, in his opinion, the now official process of determining strychnine had been dried out and condemned years ago. This remark was, at that time, not without justification. All

those who have tried the official process of estimating strychnine no doubt experienced that at times the method "works," while at other times it is plainly seen that the oxidation of brucine does not proceed as it should. It is well known that the oxidizing effect of nitric acid depends largely on conditions of concentration and temperature under which it acts; thus, Gordin has pointed out that the often incorrect results obtained with the official process are due to the fact that the method adopted directs the use of a nitric acid having a lower concentration than that which he proposed. Farr and Wright, in England, have studied the method and propose to increase the oxidizing effect of nitric acid by allowing the reaction to go on at a somewhat elevated temperature. In the United States, H. M. Webster and R. C. Pursel have studied the method in detail. They apparently have solved the difficulties experienced with this method by adding to the nitric acid a small quantity of sodium nitrite whereby the oxidation of brucine is insured.

The Assay of Coca.—It is well known that cocaine is the methyl-benzoyl-ester of ecgonine and that it is very readily decomposed with formation of the mother substance, ecgonine. While, formerly, in the manufacture of cocaine great care was taken to avoid the decomposition of this alkaloid, at the present time coca leaves are treated in such a way that the alkaloids are decomposed so that ecgonine is obtained. This body, after its isolation, is then treated so as to reintroduce the methyl and the benzoyl group so as to again yield cocaine. When coca leaves are used for the manufacture of cocaine their commercial value depends on the amount of ecgonine which may be obtained from them, and accordingly methods have been proposed for the assay of coca leaves based on their ecgonine content. A method recently proposed extracts the total alkaloids from coca leaves and then converts them to ecgonine chloride by boiling with very dilute hydrochloric acid. After removal of bodies other than ecgonine chloride, the liquid obtained is evaporated to dryness and the ecgonine chloride is weighed.

THE PHARMACOPŒIA FROM THE VIEW POINT OF AN ANALYTICAL WORKER.[1]

By W. A. Pearson.

The Pharmacopœia has been called the pharmacist's Bible. In it he finds directions for preparing, tests, and standards for his most important wares.

Our national standard has been well compiled. Much praise and little condemnation belong rightfully to the Revision Committee. This publication represents the combined efforts of competent men. Being the result of human effort it cannot possibly be infallible, nor can it be ideal for the varied needs of the retail druggist, manufacturing chemist, wholesaler and analyst.

To the analyst certain requirements present themselves in the examination of pharmaceuticals by U.S.P. methods, that allow of some flexibility and might be made more definite by the use of methods I will outline later. To a few changes and additions that might prove advantageous, I will ask your attention.

Acacia.—Four grades, A, B, C and D, are sold, depending largely on color and general appearance. Some more definite color standard would be valuable.

Acetic Acid.—Strength could be raised materially without loss to manufacturer.

Hydrochloric Acid.—Standard strength could be raised to 35 per cent.

Salicylic Acid.—Special tests should be introduced for limit of ortho and meta creasotic acids which may be present in synthetic acid.

Aconite.—The criticism that the pharmacopœial assays of this drug and its preparations are unworkable, is false, yet there is plenty of room for improvement. It requires a great deal of time to filter and wash the concentrated extractive, and the evaporation at a temperature below 60° C. is tedious. The physiological dilution test is of some value in quickly approximating the value of this drug. This test is based on the assumption that six milligrammes of prime aconite root, when mixed with 4 c.c. of water and held in the anterior portion of the mouth for one minute and then discharged, will give

[1] Read before the Philadelphia Branch of the American Pharmaceutical Association, January 7, 1908.

a tingling sensation in fifteen minutes which will continue for about half an hour. Of course it is necessary to determine the individual sensitiveness of the operator, when comparative results may be approximated. A more satisfactory assay is needed and the solution of this problem may be found in the Pharmacological Laboratory.

Aconitine is so variable that uniform results from its use can only be hoped for after physiologic assay.

Aloin.—The statement has been made that the tests are too stringent, and one manufacturer has marked his brand "U.S.P. quality commercially unobtainable."

Asafetida.—It has been found difficult to obtain this drug with less than 15 per cent. ash. The rejection of many cases by the Government chemists has materially decreased the ash content on recent consignments.

Balsam Peru.—U.S.P. tests must be followed in detail as there are artificial products that conform to nearly every requirement. A limit should be inserted in regard to length of time the green color in the rosin test may remain without being called permanent.

Belladonna, *Hyoscyamus*, *Stramonium*, *Scopolia*, and their preparations are quite accurately and satisfactorily assayed by U.S.P. methods. In the assay of the liquid preparations it is quite difficult to see the line between the liquid and the solvent. In percolating the crude drugs for assay, and in the case of extract of hyoscyamus, more menstruum is advantageous.

Chloroform.—Are tests given sufficient to detect harmful products in lots that are to be used for anæsthesia? A small per cent. of ethyl chloride seems to be advantageous.

Colchicum and its Preparations.—Here we have a delicate alkaloid and a tedious assay method, which may be necessary, but I agree with Professor LaWall, who says that he wishes the man who originated the method had to use it continually to make his living.

Collodium.—A test for tensile strength might well be introduced.

Copaiba.—A shorter test for turpentine and the addition of Turner's test would be advantageous.

Convallaria and its Preparations.—Physiologic assay should be introduced.

Cresol and its Compound Solution.—Color standards and germicidal tests should be adopted.

Digitalis and its Preparations.—Physiologic assay should be introduced.

Ergot.—As this drug is often partly or completely inert, physiologic assays should be introduced.

Fluid Extracts.—The popular idea that 1 c.c. of a fluid extract represents 1 gramme of drug is fallacious in the case of assayed fluid extracts. Very rarely does this class conform to this standard, as they are adjusted to the alkaloidal assay strength, irrespective of the amount of drug. On a large scale, the formulae and proportions given in the Pharmacopœia are not always ideal for larger quantities.

Gelsemium.—This drug seems to vary in wide limits both in action and in alkaloidal strength. An assay should be introduced.

Thyroid and Suprarenal Glands should both be tested physiologically.

Malt.—An assay for starch converting power should be introduced, as many commercial grades are inert.

Musk.—An odor limit test is advisable.

Nux vomica.—This assay is long and tedious and perhaps not ideal, especially where the oxidation of brucine takes place. Even with great care and seemingly like conditions, one sample may turn red much faster, and this has led us to modify the method to the extent of adding 1 c.c. of a 5 per cent. solution of sodium nitrite immediately after adding the nitric acid. This insures complete destruction of brucine.

Ethereal Oil.—The yield is so variable by U.S.P. method and the value so questionable, that it might be eliminated.

Oils of Birch and Wintergreen.—More efficient tests for artificial methyl salicylate are imperative. Tests for ortho and meta creasotic acids which may be present in synthetic products, might aid in the detection.

Oil of Hedeoma.—It is said that pure oils have an optical rotation as high as + 25°. Certain it is that if the maximum of + 22 were raised 3°, it would include many more samples that are now being offered.

Oil of Linum.—The solubility in absolute alcohol is given far too high. The freshness of the oil seems to render it more soluble, but from oil expressed and immediately tested, the solubility will not come in the limits. Many samples require over 25 parts for solution.

Oil of Tar.—A specific gravity of ·892 is exceedingly low, and the yield of this grade of oil is very meager.

Oil of Turpentine.—The test for petroleum benzin, kerosene, or similar hydrocarbons, may prove unreliable if allowed to stand overnight.

Oil of Thyme.—French chemists say that potassium hydroxide should be used in the assay for phenols as sodium hydroxide will eliminate carvacrol.

Opium.—It is impossible to adopt a method for this drug that will suit all analysts. Certain it is that the conditions have much to do with the results. My only suggestions are to work as nearly as possible at the same temperature, about 25° C., allow the freshly precipitated morphine to stand the same length of time, and use lime water that is U.S.P. strength. Comparative results will then be obtained.

Pancreatin,—The assay is not ideal, as there is no sharp line between the dextrin reaction and the starch reaction. The five-minute digestion period must be accurately measured if comparative results are expected. Thirty seconds difference in time of digestion will show results widely divergent. It is wise to transfer the thick starch paste from the flask in which it was boiled to a clean one, straining through cheese cloth if lumps are present. Often lumps will adhere to the sides and not be converted, and later will give an elegant starch reaction.

Pepsin.—It is difficult to press egg albumin through a No. 40 sieve, a quick method is to squeeze it through strong cheese cloth while still warm, immediately weigh, add the dilute acid and shake vigorously, which will completely disintegrate the albumin. Comparative results are only obtained by closely following every detail in the digestion.

Phenol.—Care must be exercised in obtaining the sample for analysis. A good way is to cut the crystals from a drum that has just been opened and immediately transfer to a perfectly dry bottle, melt and obtain congealing point. The assay of phenol is both rapid and very accurate.

Resin of Scammony.—Perhaps this resin is not completely soluble in oil of turpentine as required, as a sample made directly from Scammony root by U.S.P. method, fails to completely dissolve.

Sugar of Milk.—The test for absence of cane sugar is fallacious.

Thymol Iodide.—An official method for assay is desirable as divergent results are obtained by different methods.

It is often a matter of judgment in deciding whether a certain sample is U.S.P. quality, because in limit tests depending on shades of color or degree of turbidity the requirements are quite flexible.

The various shades of color could easily be compared with a standard chart such as accompanies certain text books on organic chemistry and a definite limit given.

Similarily the degree of turbidity could be indicated by some such scheme as Dr. McFarland's Nephelometer (*J. A. M. A.*, October 5, 1907).

The subject of detecting inferior and adulterated volatile oils is a problem difficult of solution, but the detection might be aided by the introduction of an odor limit test. By this I mean a certain oil should still have a characteristic odor, unaltered when diluted to a certain volume.

The dilution could easily be accomplished by adding 1 c.c. of the oil to 99 c.c. of alcohol, then 1 c.c. of this to 99 c.c. of dilute alcohol, then 1 c.c. of this to 99 c.c. of water.

These dilutions to be varied to suit the oil.

The odor of the best grade of some oils is extremely tenacious, while that of their substitutes and those of inferior quality is much less persistent.

The introduction of official methods for obtaining boiling, congealing, and melting points, and the determination of alcoholic strengths, would give much more uniformity to these determinations.

Another step toward uniformity would be made if the alcoholic strength of tinctures and fluidextracts of the same drugs would be made the same, unless there are good reasons for variation.

More liquid should be recommended in several alkaloidal assays for extraction and washing purposes.

I consider that the Pharmacopœia should be the guide to all important materials used in the treatment of disease. If we consider the Pharmacopœia from a scientific view point, we must look forward and anticipate what the therapeutics of the future will be.

Unquestionably therapeutics of to-day is far from uniform, and different schools have sprung up like mushrooms and claimed merit for their particular methods. That each class has many able followers cannot be denied. Certain it is that medicine and pharmacy are breaking all bands of mythology, and that the ultimate therapeutics will be rational therapeutics gleaned from what is best from each system.

Pharmacy as the science and the art of preparing products for the treatment of the sick is broader than ever before. The widely diverging therapeutics demand special service.

If we believe in psychological therapeutics, we have our field in writing arguments to convince those who think they are sick that they are not.

If hydropathy is to be practiced, we must be prepared to furnish the proper kinds of water.

If osteopathy prevails, we must provide all appliances needed for that practice.

If vaccine therapy is the important remedial agent, we have our field in the preparation. Just so with all the other special branches of therapeutics. Few pharmacists realize their scope, but hang tenaciously to the mythology of unimportant drugs.

If I may indulge in further speculation, I would say that the therapy of the future will be mainly preventive or prophylactic practice, and adherence to only the remedial agents that have proved particularly efficacious. For example: Small pox has practically been eradicated by scientific use of vaccine. Serum therapy has greatly decreased the mortality of diphtheria and bids fair to hold its place in the treatment of that disease. Tuberculosis can effectually be fought with a combination of fresh air, isolation and tuberculin. Just so with other maladies, the ultimate treatment will tend toward uniformity after this period of adjustment. Of course, death is necessary to life, so human suffering can never be banished, yet the more common diseases to which we are subject may at last be overcome and the body run evenly for "three score years and ten," when it will fall to pieces as did "The one horse shay."

Why is this speculation important to pharmacists? Because we are concerned in the preparation of the products that are to be used and we must be able in some way to discriminate. To my mind, rational therapeutics will be the final victor and it is the one we should follow. We are a long way from the final goal, but have seen some important advances, of which standardization is a vital one.

Alkaloidal assay has added a remarkable stimulus to uniformity, but all our active drugs are not capable of such valuation.

The test of the pudding is in the eating, not in the appearance, size, color, number of raisins, per cent. of proteid, fat or starch.

Just so with the digitalis, ergot, strophanthus, convallaria, squill, Indian cannabis, thyroid and suprarenal glands, you cannot judge them by appearance, but it is possible to standardize them comparatively by physiological means. Uniformity is the important slogan. Therefore I would suggest that physiological standards be introduced in the Pharmacopeia. True, the tests could not be done accurately by the busy retail pharmacist, nor can standardization of antitoxin, or, in fact, one of the common alkaloidal assays.

The whole scheme could be accomplished under the same method as is now in force in standardizing antitoxin. The Government to send out standards for comparison to each manufacturer, as often as deemed necessary, and uniformity would result without the humiliation manifested by one of our leading Philadelphia physicians, who was called hurriedly in consultation to see a case of alarming toxic digitalis symptoms. The physician who had given the drug said, "Let me throw that stuff out the window." "Give it to me," said the consulting physician, "for I can never get any that will work."

With these suggestions, some of which I trust you may think of favorably, I must conclude this inadequate survey of a subject which is of vital importance to us all. It only remains for me to thank you for your courteous attention.

THE PHARMACOPŒIA AND THE MICROSCOPIC EXAMINATION OF VEGETABLE DRUGS.[1]

By Henry Kraemer.

I have been asked by the committee having this meeting in charge to discuss (*a*) the subject of the microscopic examination of vegetable drugs, (*b*) the introduction of histological descriptions into the U. S. Pharmacopœia, and (*c*) to consider any of the difficulties which stand in the way of introducing such descriptions into the Pharmacopœia. In presenting this subject I have deemed it advisable to treat it under three heads. These are:

(1) What has been done by some of the other pharmacopœias.

(2) The Eighth Revision of the U.S.P.

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[1] Read before the Philadelphia Branch of the American Pharmaceutical Association, January 7, 1908.

(3) What the next Committee of Revision will probably do, and why.

I. FOREIGN PHARMACOPŒIAS.

The fourth edition of the German Pharmacopœia appeared in 1900. In the preface it is stated (page xv) that for practical reasons the description of crude drugs has been considerably changed, the thought being that as the majority of the drugs used to-day by the apothecary are in a comminuted or powdered condition, the description of the more important drugs should be enlarged and histological characters introduced. From a half to two-thirds of a page is usually given to the definition and description. There is no separation into paragraphs of the definition, and the macroscopic and microscopic descriptions. Apparently, it was thought that the histological characters should be taken into account not only in the examination of powdered drugs, but also in the examination of comminuted drugs where it would be necessary to make sections, as well as of crude drugs where a microscopic examination in many instances would help very considerably.

As showing the idea of the revisers of the German Pharmacopœia we may select the description of ipecac, omitting the method of alkaloidal assay.

Radix Ipecacuanhae—Brechwurzel.

Die getrocknete, verdickte Wurzel von Uragoga Ipecacuanha. Die Wurzel ist höchstens 5 mm dick und durch Wülste der außen dunkelgraubraunen Rinde geringelt, welche sie mehr oder weniger weit umfassen. Die innen weißliche Rinde ist von einer braunen Korkschicht bedeckt und besteht, außer den Siebröhren, nur aus Parenchymzellen, welche meist zusammengesetzte Stärkekörner und Bündel von nadelförmigen Oxalatkrystallen enthalten.

Das harte, hellgelbe Holz besteht allein aus den in der Längsrichtung der Wurzel gestreckten, dickwandigen, verholzten Ersatzfasern, mit schräg gestellten, spaltenförmigen Tüpfeln und aus Tracheen, deren Glieder den Ersatzfasern ähnlich, jedoch behöft getüpfelt und meist durch runde, seitlich und den Enden genähert liegende Löcher verbunden sind.

Der Durchmeſſer der größten Einzelkörner der Stärke ſoll 0,012 mm nicht überſchreiten.

About the time that the eighth revision of the U. S. Pharmacopœia appeared the Netherlands Pharmacopœia was issued. In this work, as in the German Pharmacopœia, about an equal amount of space is given to vegetable drugs and chemicals. The descriptions in the Netherlands Pharmacopœia are, however, much more complete and extended, a page or more frequently being given to the description of vegetable drugs, one-half of which pertains to the microscopic characters of the powders.

For the sake of comparison, as well as to get an idea of the character of the work, the description of ipecac may be selected as an example:

RADIX IPECACUANHAE.

Radices adventiciae tumefactae quas praebet Psychotria Ipecacuanha, STOKES, Bot. Mat. Med. I. 365 (Uragoga Ipecacuanha, BAILL. Hist. Pl. VII. 281).

Decimetra ad 1,5 longa, sed plerumque fracta in frusta centimetra non plus quam 5 ad 7 longa, millimetra ad 5,5 crassa, dura, fragilia, cylindrica vel subconica, semper plus minusve enormiter flexa, raro paulum ramosa, tumoribus densis, orbicularibus, fere millimetrum 1 latis, qui plerumque radicem non plane circumdant, at loca non tumefacta in singulis tumoribus in diversas partes versa sunt, ita ut tota radix satis constanter cylindrica sit; iis tumoribus multis locis rimae interiectae sunt undique usque ad lignum pergentes. Superficies tenuiter transverse rugosa, non nitide, obscure griseofusca, nonnunquam magis rubrofusca. Corticis fractura transversa clare griseofusca, levis, non nitida, cornea, nonnunquam farinulenta; fractura ligni alba. Lignum millimetra ad 2 crassum, transverse persectum quodammodo angulosum; hic illic cortex facile a ligno avellitur.

Ad usum cortex ligno liberetur.

Microscopia pulveris. Amylum, plurimum grana soluta, sed etiam in cellulis parenchymaticis leptotichis, coloris expertibus; granorum multa simplicia, diametro non plus quam 12 μ, fere globosa, nucleo et stratis parum conspicuis; at plura composita, pleraque diadelpha vel triadelpha vel tetradelpha sed interdum ad dodecadelpha, parti-

bus saepe valde disparibus. Cellulae suberosae formam orbis exhibent, sunt quinquangulae vel sexangulae, leptotichae, membranis obscure rubrofuscis. Raphides fere 45 μ longae, tenues, interdum in fasciculos intra cellulas parenchymaticas collectae. Xylematis elementa fibrosa, pachyticha, partim scrobiculis rimalibus, partim scrobiculis duplicibus praedita, in pulvere fere nulla adsint.

Odor corticis, imprimis cum contunditur, mucidus; sapor ingrate amarus. Lignum odoris et saporis expers est.

Pulvis Radicis Ipecacuanhae combustus cineris partes centesimas 1,8 ad 6 relinquat.

If the practice of pharmacy in the Netherlands has reached that stage of advancement indicated by this book, and I have good reason to believe that it has from a short sojourn in that country, with what pride must the pharmacist practice his profession! Not only is the book of the highest standard, but it is in the Latin language, which shows the standard of education which must be attained by Dutch pharmacists.[1]

2. THE UNITED SPATES PHARMACOPOEIA.

Shortly after the 1900 convention, Dr. Rice, chairman of the U.S.P. Revision Committee, called me to New York as chairman of the Sub-committee on Botany and Pharmacognosy, which he had appointed, to go over this subject, he having been very much impressed with the work of the German Commission, and in order to facilitate the work in our own revision gave me this copy of the German Pharmacopoeia, which I hold in my hand.

In little more than a year after the Convention, the chairman of the sub-committee on Botany and Pharmacognosy presented in a preliminary report completely revised descriptions of the vegetable drugs for the consideration of the general committee. To indicate the nature of the work that was done we select here as previously the part relating to ipecac.

IPECACUANHA. Ipecac.

The dry root of Uragoga Ipecacuanha Baillon (Fam. Rubiaceae), known in commerce as Rio Ipecac.

[1] A paper treating of the subject of vegetable drugs as set forth in the various foreign pharmacopœias is now in contemplation.

Cylindrical, somewhat tortuous; 5 to 15 cm. long, 1 to 5 mm. in diameter. Externally dark brown, irregularly annulate, sometimes transversely fissured; occasional rootlets or rootlet scars. Internally, bark light brown, 0·5 to 1 mm. thick, easily separated from the dark yellow, non-porous wood; fracture of bark brittle, of the wood tough; odor slight; taste bitter, acrid.

Stems usually more slender, 5 to 10 cm. long, 1 to 1·5 mm. in diameter; nearly smooth or longitudinally wrinkled, bark 0·1 mm. thick, with bast fibers either single or in groups; pith distinct, 0·5 mm. in diameter.

Carthagena Ipecac. Uniformly thicker roots, 4 to 7 mm. in diameter, annulations less pronounced.

Powder. Dark yellow; tracheids with simple, oblique or bordered pores, sometimes containing starch; calcium oxalate in raphides 20 to 40 μ long; starch grains elliptical, 4 to 14 μ in diameter; single or 2- to 4-compound. In Carthagena ipecac the starch grains are uniformly larger, 4 to 15 μ in diameter.

The crude drug descriptions embraced from four to nine lines, and the descriptions of the powders were two to three lines long. In some cases, as where the entire tops of the herb drugs are used, the descriptions were longer. The report having been submitted to an officer of the Convention, he prepared an extended criticism in which he objected to the introduction of scientific terms in the descriptions of crude drugs and to the introduction of descriptions of powdered drugs.

Two main reasons advanced in favor of his position were as follows:

(*a*) Very few of the active pharmacists in our country are college graduates; and even if all the graduates of all the schools of pharmacy in this country were still alive, and all were still actively engaged in the business, they would be but a small proportion of the whole number engaged in the business of pharmacy.

(*b*) The Convention had before it a proposition to introduce descriptions of powdered drugs (proposed by Professor Schneider) and voted it down; another effort at a subsequent session to get at the same result was to refer to the Revision Committee, many voting for this motion to avoid a re-opening of the debate on the subject, and confident that the Committee would carry out the expressed wish and will of the Convention.

It is now proposed by the sub-committee to introduce the descriptions of the microscopical appearances of powdered drugs. It is not necessary to argue this subject at great length here; it was fully realized by the Convention that the introduction of this subject into the Pharmacopœia might result in endless persecutions and prosecutions of retail pharmacists, and the Convention is on record as disapproving af the scheme.

A third argument against the introduction of descriptions of powdered drugs was presented by a member of the general committee who stated:

It is certain that much more space will have to be given to assay processes, and the chemical descriptions will likewise have to be extended in the new book. The increased number of synthetics which will be added, will still further enlarge the book, and there are other additions which will undoubtedly be made, and it is therefore necessary at this time, to take the question of space into serious consideration.

We may then summarize the chief objections which were raised against the introduction of powdered drugs and any extension of the descriptions of crude drugs:

(*a*) General lack of education among pharmacists in the United States.

(*b*) A fear that pharmacists would be persecuted unduly if the characters of powdered drugs were given.

(*c*) Lack of space on account of the introduction of additional assay processes, synthetics and other matters.

Finally, the sub-committee was instructed by the General Committee to prepare a report on the vegetable drugs of the Pharmacopœia according to the following:

(1) The botanical and pharmacognostical descriptions of the drugs entering the U.S.P., 1900, shall be framed in a manner similar to those found in the last

Pharmacopœia, with such corrections and additions as the advance in science demands, but still retaining the style as to terminology and other technical characters adopted in the U.S.P., 1890.

(2) Descriptions of powdered drugs are excluded from the U.S.P., 1900, subject to the following provision: when a drug in the powdered state is known, or reasonably supposed to be subject to a specific adulteration or admixture, there may be such a reference to its powder as shall suffice, in a simple and easy manner, to provide for the detection of such adulterants or admixture, and in other cases, where similar objects are required, brief references to the characters of the powders may be made.

The following summer (1902) the sub-committee prepared a second preliminary report in accordance with the above instructions, which was accepted, and is incorporated in the present Pharmacopœia, with the exception of certain changes which were made while the work was going through the press.

While the treatment represents certain advances, it is, however, inadequate for purposes of identification of not only powdered drugs but crude drugs as well, and it becomes necessary to consult other works for additional information on the identity characters of the official drugs, this feature of the book comparing unfavorably with that portion devoted to the descriptions of chemicals, which are quite replete with identity tests that are sufficient for all practical purposes.

It is not my object to discuss this matter other than for the purpose of showing how a resolution of the Convention may affect the work of the Committee of Revision, and how the work of a special or sub-committee may be hindered by the votes of twenty or more men who are not familiar with the progress that has been made, and with the trend of events in a particular field outside of their own.

This is probably one of the weakest places in pharmacopœial revision, where men who are specialists in one line are permitted to vote on other subjects in which they have not special knowledge, and I, on my part, have hesitated during the course of revision to vote on questions which I did not feel competent to consider.

As we have no assurance that the same arguments will not be put forth again in connection with the revision of the Pharmacopœia, we may briefly consider them at this time.

It seems to me to be a sad commentary on the status of pharmaceutical education in this country, that the Committee of Revision

should be prevented from considering the scientific problems arising during the course of revision on their merits, or in such a manner as the importance of the subject warrants, or the practice of the times demands, by reason of the oft-expressed contention that pharmacists are not educated in such a manner as to be able to make use of the knowledge given, or to appreciate its importance. If, however, it be admitted that this contention is true, then the question narrows itself down to this, that pharmacopœial revision is directly influenced, or hindered from making progress, by the inadequacy of the pharmacist's education.

Whatever may have been true of the past certainly cannot long continue to be true of the future, for the reason that the responsibility must be directly assumed by the schools and colleges of pharmacy and by the boards of pharmacy. We can therefore but trust that this argument relating to the pharmacist's education will never again be raised in connection with pharmacopœial revision.

The second argument when reduced to final analysis means that we are more concerned in avoiding prosecutions and litigation than in safe-guarding the quality of the drugs which the pharmacist handles. This, however, is a question which is now in the hands of the Government, and it would seem that the sooner the Pharmacopœia recognizes powdered drugs and modernizes its attitude toward the whole subject of vegetable drugs, the more weight and authority it will have as a legal standard. There are some who still contend that drugs in the powdered or comminuted condition are not official and therefore are not required to be subject to the official standards. Technically there can be no question that both crude and powdered drugs should conform to the same standard. This is true of the foods and spices for which the government has established standards. Furthermore, as I have already pointed out, there are a number of products official in the U. S. Pharmacopœia which are used for spices or for flavoring purposes for which no definite standards are given, while the U. S. Government has adopted exact standards relating to the quality of these products. This emphasizes the desirability that the revisers of the Pharmacopœia take advantage of scientific investigation pertaining to every official product and fix exact standards for them. In other words standards are fixed legally according to the advance in our scientific knowledge of the subject.

Not much need be said in regard to the third objection, as no principle is involved, other than to suggest that in the next revision the space in the Pharmacopœia be provisionally apportioned in advance, so that one department need not be handicapped or denied a proper amount of space on the ground that other departments require it.

III. VEGETABLE DRUGS IN THE NEXT PHARMACOPŒIA.

It is rather difficult to say at this time just what will be done by the next Revision Committee with regard to the subject of vegetable drugs, but it may safely be assumed that it will not be content to lag much behind the other pharmacopœias in this respect. Not only is this true, but if closer relations are established between physicians and pharmacists, will not the physician expect that when he uses such drugs as aconite, digitalis, ergot and others that the pharmacist shall be familiar with the latest researches on these drugs, just as he, in turn, is expected to be familiar with the latest advances in medicine? In order that the pharmacist may live up to this requirement and be assured that the drugs which he buys are genuine and of good and uniform quality, it is necessary then that the framers of the Pharmacopœia take cognizance of the advances in pharmacognosy, as has already been done by other pharmacopœias.

With the increased use of the microscope in the examination of various technical products, and with the appearance of so many works on the microscopical study of drugs, foods and spices, and with courses of instruction in all of the reputable colleges of pharmacy, in which the microscope comes into daily use, its value in the examination of both crude and powdered drugs can not be questioned. In this connection, I may refer to some of my earlier papers on this subject,[1] and before considering briefly the specific application of the microscope in the study of vegetable drugs, I desire to say something on

THE RELATIVE VALUE OF CRUDE AND COMMINUTED DRUGS.

It would probably be supposed that as I have devoted considerable attention to the study and development of methods for the

[1] AMERICAN JOURNAL OF PHARMACY, 69 (1897), p. 400; and 71 (1899), p. 541.

examination of powdered drugs I might be led to overlook the relative value of crude and powdered drugs. We all know the relative perishability of crude drugs depending upon the nature of the constituents, some deteriorating so rapidly as to make it necessary to use them in a fresh condition, as pulsatilla, bryony and conium. It is true that there are a few vegetable drugs which are improved by keeping them for a certain length of time, but generally speaking they deteriorate more rapidly in the powdered condition than in the crude condition. Another objection to the use of powdered drugs is the fact that they lend themselves more readily to adulteration and to the use of poor grades of drugs, which ofttimes would be rejected if offered for sale in the crude condition.

Dr. Squibb's papers[1] on the study of rhubarb are not without interest at this time. From his observations he concluded that "no ordinary judgment is at all to be depended upon in the selection of powdered drugs," and he even went so far as to say that "the importation of any drug in powder is *prima facie* evidence that there is something to be concealed by the condition of being in powder, and this evidence should be taken as overbalancing all other evidence in the case of medicinal substances, until it can be annulled by proof to the contrary." At this time we do not insist that every powdered drug upon the market should be looked upon with suspicion, but that it is much more difficult to identify and pronounce upon the quality of a drug in the powdered condition than in the crude condition. In view of these various considerations it would probably be better if pharmacists made their preparations from crude drugs. But inasmuch as comminuted and powdered drugs are mostly purchased by retail druggists it becomes necessary for the Pharmacopœia to consider methods for their examination if the revisers desire the Pharmacopœia to be of use to pharmacists in this respect. That the work is technical does not argue against its consideration, but should, it would seem, be all the more reason for giving it attention. Either the Pharmacopœia should admit descriptions of powdered drugs, or extend the descriptions of the histological characters of crude drugs, the elements being identical in each case, only in the crude drugs they have a relation to one

[1] Proceedings of the American Pharmaceutical Association, 16 (1868), p. 452: 17 (1869), p. 398; and 19 (1871), p. 497.

another in the arrangement or grouping into tissues. As already pointed out the latter method is followed in the German pharmacopœia.

THE USE OF THE MICROSCOPE IN THE EXAMINATION OF COMMINUTED AND POWDERED DRUGS.

The microscope furnishes the surest means of determining the identity of a powdered vegetable drug at our command, and is also useful in determining the quality of powders, as in strophanthus, hydrastis, ginger, black pepper, amylum, etc. The microscope also furnishes the most reliable means of detecting and determining adulterants in powdered drugs. It is furthermore useful in detecting the presence of worm-eaten drugs or powders of certain classes of drugs which have been exhausted in whole or in part.

When the active principles of starch-containing drugs have been removed this is indicated by an alteration in the starch grains, as in belladonna, calumba, ipecac, rhubarb, licorice, etc. Exhausted oleo-resinous drugs are readily detected by the use of chloral as a mounting medium, which has the effect of bringing out the oil and resin cells in the genuine drug. There are also a number of microchemical tests which apply to individual drugs that are coming into use. The presence of added lime in cochineal and other drugs may be detected by the use of 25 per cent. sulphuric acid, as a mounting medium which causes a separation of crystals of calcium sulphate.

I have had a great many occasions to use the microscope not only in the detection of adulterants but also in determining drugs which were mislabeled. On one occasion a jobber sent out comminuted belladonna root for inula, and discovered later that the bin in which the drug was kept was wrongly labeled. On another occasion when I ordered genuine "almond meal" and a mixture marketed as almond meal, I found the labels were interchanged, apparently not wholly accidentally, but on account of the finer appearance of the spurious article.

THE VALUE OF THE MICROSCOPE IN THE EXAMINATION OF CRUDE DRUGS.

In addition to the aid furnished in identifying crude drugs by a microscopic examination as in digitalis, solanaceous leaves and

arnica flowers, there are very many cases in which the microscope will be found an aid in judging of the quality. A good deal may be learned about the quality of a drug by taking into consideration the microscopic appearance of other cell constituents than the active ones, as of starch, calcium oxalate, inulin, chloroplasts, and aleurone grains. The time of gathering the drug, the method of drying it and the length of time it has been kept may all be judged in many instances by the use of the microscope.

The spurious character of the crude drugs that have been sold in times past is well known. Some of the admixtures or substitutes can be detected with the naked eye, but in many instances a microscopic examination furnishes the surest means of determining them, as in the detection of ruellia in spigelia, spurious cascara barks, etc. I do not desire to multiply examples, but may conclude by saying that one who is accustomed to the examination of drugs by means of the microscope finds it an advantage to use it continually.

CONCLUSIONS.

When invited to discuss the subject of this paper I felt bound to accept the invitation, and to do all I could to assist in future revisions of the work, and to make clear the necessity of the consideration of the progress in the scientific study of vegetable drugs and its application in their examination.

I have pointed out what has been done by the other pharmacopœias and reviewed the difficulties which beset revision work in this department in our own Pharmacopœia.

I have shown that crude drugs are on the whole better in quality and less liable to adulteration than powdered drugs, but as comminuted and powdered drugs are so largely used, the pharmacist must be able to determine them and judge of their quality.

This being the case the Pharmacopœia should either only give definitions of vegetable drugs, leaving it to be inferred that the pharmacist will acquaint himself with the standard scientific works pertaining to them, and that these constitute the standard the Pharmacopœia prescribes, or it should make the descriptions so complete as to apply to the various commercial forms of vegetable drugs, as I have already stated.

POISON IVY FRUIT.

By A. B. Stevens.

In an article on Poison Sumac (American Journal of Pharmacy, **79**, 522), Mr. Warren and the writer referred to Pfaff's statement that he found the poison in the fruit of the poison ivy and poison sumac, and declared our belief that he must have employed fruit collected in the green state, as we had repeatedly examined the ripe fruit of both species and each time were unable to find poison. Since writing the above we have examined two samples of mature, but unripe fruit of poison ivy, and both were poisonous.

A physician once asked if poison ivy, growing in the city, was poisonous. In this connection it is interesting to note that one of the above specimens grew in Weehawken, N. J., near the dueling grounds of Hamilton and Burr, the other in the Old Dutch Cemetery in Tarrytown-on-the-Hudson.

By some oversight a part of the original copy, containing acknowledgements, was omitted and we take this opportunity to express our thanks to Frederick Stearns and Co. for their generosity in maintaining a fellowship in the School of Pharmacy, University of Michigan, which made part of this work possible, and also to Adolph Ziefle for continued assistance, especially in the collection of the latex. In the illustration, p. 506, Mr. Ziefle appears on the right and Mr. Warren on the left.

SHARE-HOLDING IN NOSTRUM COMPANIES BY PHYSICIANS TO STOP.

"Section 4 of Article I of the By-Laws of the Philadelphia County Medical Society provides: 'Any physician who shall procure a patent for a remedy or for an instrument of surgery, or who sells or deals in patent medicines or nostrums, or who shall give a certificate in favor of a patented or proprietary remedy or patent instrument, or who shall enter into an agreement with an apothecary to receive pecuniary compensation or patronage for sending his prescriptions to that apothecary, shall be disqualified from becoming or remaining a member.'

"The holding of shares of stock in a company making or dealing in patented or secret medicines is, therefore, incompatible with membership in the Philadelphia County Medical Society. This

notice shall be printed in three successive issues of the *Weekly Roster* of the medical organizations of Philadelphia."

The foregoing action, adopted at the annual meeting on January 15th, means expulsion for offenders from the County Society, the State Society and the American Medical Association, after expiration of the three notices mentioned.

THE PHILADELPHIA BRANCH OF THE AMERICAN PHARMACEUTICAL ASSOCIATION.

The stated meeting of the Philadelphia Branch of the American Pharmaceutical Association, for January, was devoted to a discussion of the valuation of drugs and assay processes. The meeting was an unusually interesting one and demonstrated, more than any of the previous meetings, the imperative need for post graduate work on the part of retail pharmacists, if they wish to keep abreast of the needs and requirements of the science of pharmacy to-day.

The first paper was one contributed by Professor W. A. Puckner, of Chicago, entitled: "Recent Progress in the Chemistry of Alkaloid Estimation." This paper included quite a comprehensive review of the progress that has been made during the past twenty years in the quantitative estimation of alkaloids in crude drugs.

A paper by Mr. W. A. Pearson on: "The Pharmacopœia from the View Point of a Scientific Worker," included a number of suggestions for the elaboration or modification of the tests for official articles.

Mr. Pearson also pointed out the need for adopting physiological standards and tests for such drugs as aconite, colchicum, digitalis, ergot, thyroid gland and suprarenal gland.

A joint paper by Dr. E. D. Reed and Mr. Charles E. Vankerkleed on: "The Standardization of the Preparations of Digitalis by Physiological and Chemical Means," brought out a number of interesting facts relating to the possibilities of adopting standards for this really important drug. The work done by Dr. Reed and Mr. Vankerkleed shows that there is a remarkable uniformity between the results obtained by physiological tests and the quantitative determination of the contained digitoxin by chemical means. The results so far obtained it was thought would warrant the continuation of the belief that digitoxin represents fairly well the active constituents of digitalis.

Prof. Henry Kraemer read a paper on: "The Pharmacopœia and the Microscopic Examination of Vegetable Drugs." In the course of this paper he reviewed the descriptions of crude and powdered drugs that have been included in the more recent European pharmacopœias and discussed at some length the reasons why equally satisfactory descriptions had not been included in the recent, eighth decennial, revision of our own pharmacopœia. Even at the present time the value of the compound microscope in determining the identity of crude drugs and in detecting adulterations, contaminations, deterioration and changes caused by exhausting the drug, is thoroughly well established and the very near future will undoubtedly demonstrate that the microscope is absolutely indispensable in the examination and valuation of all drugs of vegetable origin.

Prof. Chas. H. LaWall, in discussing the papers that had been presented, pointed out that the subject of alkaloidal assay was one of very great importance and suggested that variations in results are not infrequently obtained through careless sampling.

Prof. I. V. S. Stanislaus suggested the advisability of working out a reliable method for determining the camphor content of camphor liniment and spirit of camphor.

The papers were liberally discussed by a number of the members and visitors present.

The meeting of the local branch, for February, will be devoted to the consideration of: "The Retail Druggists' Responsibilities in Connection with the Great Black Plague."

M. I. WILBERT,
Secretary.

PHILADELPHIA COLLEGE OF PHARMACY.

The quarterly meeting of the members of the College was held December 30, 1907, at 4.30 P. M. in the Library. The president, Howard B. French, presided. Twelve members were present. The minutes of the semi-annual meeting, held September 30th, were read and approved. The minutes of the Board of Trustees for the meetings held September 12th, October 1st and 5th, and November 6th were read by the Registrar and approved.

A large portrait of the late James T. Shinn, treasurer of the college, was presented by our fellow member, F. Gutekunst, the well known

photographer of Philadelphia. The portrait is an enlargement of the one published in the November JOURNAL in connection with the biographical sketch of Mr. Shinn by Dr. John F. Hancock. The portrait is printed on Willis and Clements best platinum paper, which is said to be very durable.

The portrait was an admirable likeness of Mr. Shinn and the members were greatly pleased in receiving such a speaking likeness of the late treasurer. It was unanimously voted that the thanks of the College be tendered the generous donor.

The president announced that the death of Mr. Shinn occurred on October 4th, after an illness of a few hours.

The president reappointed the following named gentlemen to the Committee on Legislation: M. N. Kline, chairman; Joseph P. Remington, M. I. Wilbert, William McIntyre, W. H. Poley.

Mr. George M. Beringer, on behalf of Mrs. Mary Procter Green, of Florida, a daughter of the late Prof. William Procter, Jr., presented a number of letters from the correspondence of her father, and in view of their great historic value, he suggested that they be carefully preserved, and also published in the AMERICAN JOURNAL OF PHARMACY, and that suitable acknowledgment be made to Mrs. Green, which was approved.

The letters are as follows:—

To William Procter, Jr.

ESTEEMED FRIEND: On behalf of the Board of Trustees of the Philadelphia College of Pharmacy it has become our pleasing duty to inform you that at a special meeting of that body, held at their hall last evening, you were unanimously elected Professor of Pharmacy in the School of Pharmacy of that College. With the best wishes for your health, and for the successful prosecution of the arduous and untried duties devolving upon the station you have been chosen to fill, we subscribe ourselves, your friends.

THOMAS P. JAMES,
Chairman of Board of Trustees.

EDWARD PARRISH,
Secretary.

PHILADELPHIA, June 2d, 1846.

(This letter bears evidence of having been written by Edward Parrish, with the exception of the signature of Thomas P. James.)

AMERICAN PHILOSOPHICAL SOCIETY,
INDEPENDENCE SQUARE,
PHILADELPHIA, 16th April, 1847.

SIR: I have the honor of informing you that you have been this day elected

a member of the American Philosophical Society, held at Philadelphia for promoting useful knowledge.

I am, sir,

Your obedient servant,

JOHN F. FRAZER, *Secretary.*

WM. PROCTER, JR.,
Present.

RESPECTED FRIEND: Thy official note of the 16th inst., conveying the information of my election to membership in the American Philosophical Society was duly received. Be pleased to inform the Society that I am sensible of the honor conferred on me by their act of consociation, originating as it did in their body, and that I accept it.

With much respect,
I am thy friend,
WILLIAM PROCTER, JR.

To JOHN F. FRAZIER,
Secy, Am. Phil. Society.

PHILADELPHIA, April 17, 1847.

DEAR SIR.—I have the pleasure to inform you, that, last evening, you were elected a member of the Amer. Phil. Society. You will be officially notified of your election, by one of our secretaries, in the course of a few days. You are indebted to this honor, to the talents and industry you have shown in your various chemical and pharmaceutical researches, and no one thinks it more justly deserved than

Your sincere friend,
FRANKLIN BACHE.

PROF. WILLIAM PROCTER, JR.

April 3d, 1860.

MY DEAR MR. PROCTER: I send you herewith, most cheerfully, my check for $100, which I consider but a small compensation for the services rendered by you to the Committee of the Col. of Physicians in revising the Pharmacopœia.

Very truly yours,
GEORGE B. WOOD.

The secretary called attention to the accumulation of returned certificates of membership from those who had resigned or forfeited membership. The safe was being encumbered with them and some disposition should be made of them. Several members suggested destroying them. The President suggested preserving them on account of the historic value of the signatures of the Faculty and officers attached to them, and instanced one case where all the signatures were those of deceased persons. He further suggested preserving them in a large book and said that room could be found for some of them in some of the cases in the Library.

No further business appearing, adjournment was had at 5 P. M.

ABSTRACTS FROM THE MINUTES OF THE BOARD OF TRUSTEES.

September 12, 1907.

Committee on Property reported that the plans for the new laboratory were completed. The cost for building and fixtures would be about $22,000.

That the new microscopical laboratory was practically finished.

The question of raising funds to pay for the New Pure Food and Drug Laboratory was discussed, and among the plans suggested was that of securing the cooperation of the Alumni.

Committee on Library reported a number of accessions to the library.

Committee on Museum and Herbarium reported the purchase and delivery of the Bartram reprints.

Committee on Scholarships reported additional requirements governing the award.

Committee on Examinations reported the names of G. C. Davy, E. J. Fry, C. R. Keiser, and J. L. Wade, who had satisfactorily passed all examinations in Special Chemistry, and were entitled to certificates of Proficiency in Chemistry.

The secretary reported that a communication had been received from the secretary of the Board of Public Education stating that a scholarship had been awarded to a graduate of the Central Manual Training School.

October 1, 1907.

A communication received from the secretary of the college announcing the re-election of Richard M. Shoemaker, Edward M. Boring, and Charles Leedom, as members of the Board of Trustees for the ensuing three years.

Committee on Property reported the addition to the microscopical laboratory completed, and that the facilities for instruction were greatly increased. Also that bids for the New Pure Food and Drug Laboratory were received from several bidders.

Committee on Library reported a number of valuable accessions to the library.

Committee on Alumni requested an appropriation for the use of the Alumni Association—granted.

Committee on Scholarships reported that there were seventeen

applicants, and recommended the award to seven of the applicants, which was agreed to.

Committee on Examinations reported that the examinations for advanced standing were held September 27th—and were well attended.

New business.—The contract for the new building and fixtures was awarded to H. A. Havens.

The Committee on Membership reported favorably on the application of William E. Lee for membership in the college, who was duly elected.

October 5, 1907.

A special meeting of the Board was called to take action on the death of James T. Shinn, Treasurer of the College. Remarks—which were all tributes of respect—were made by Messrs. French, Baer, Mattison, Sadtler, Meyer, Rumsey, Cliffe and Wiegand.

A committee of three, Messrs. Sadtler, French and Baer, was appointed to draft suitable resolutions. It was also voted that the college be closed on the day of the funeral and that the entire Board should attend the funeral, which was to take place from the Haverford Meeting House.

In this connection was stated the interesting fact that since the founding of the college the office of treasurer had always been filled by a member of the Society of Friends. Richard M. Shoemaker was elected Acting Treasurer.

November 6, 1907.

The Special Committee appointed to draft resolutions on the death of the late Treasurer James T. Shinn, made their report, as follows:

RESOLUTIONS ADOPTED BY THE BOARD OF TRUSTEES OF THE PHILADELPHIA COLLEGE OF PHARMACY.

November 6, 1907.

WHEREAS, We have been recently called upon to record the sudden and very unexpected removal from our midst, by death, of our fellow-member, James T. Shinn, and,

WHEREAS, His services to the Philadelphia College of Pharmacy had been so conspicuous and had extended through so long a term of years, and,

WHEREAS, His personal relations to each and all of us had been so close, and he had endeared himself so strongly as a friend to all of his associates in the Board, therefore, be it,

Resolved, That we testify in a minute to be placed upon the permanent records of this Board to our feeling of the great loss sustained by the Philadelphia College of Pharmacy, its members, officers, students, and all connected in any way with its activity, in the death of James T. Shinn, the late Treasurer and Trustee of the college. Be it also further,

Resolved, That American pharmacy has lost a most conspicuous and creditable exemplar, an ex-President of the American Pharmaceutical Association, and a member of the same for nearly half a century, but, above all, a type of the honest, intelligent practicing pharmacist that brought credit to the profession. Be it further,

Resolved, That in the death of our friend, the community in which he lived has lost a useful citizen, and a public spirited friend and benefactor of many charities, and helpful civic organizations, and public movements. Be it further,

Resolved, That this minute be placed upon the records of the Board of Trustees of the college, and a copy thereof be transmitted to the family of our late friend.

[Signed] SAMUEL P. SADTLER,
HOWARD B. FRENCH,
JACOB M. BAER,
Committee.

The resolutions were unanimously adopted, ordered entered on the minutes, and a copy directed to be sent to the family.

Committee on Property reported the burning out of the dynamos on account of extreme pressure, and that, until repairs were completed, arrangements had been made with the Philadelphia Electric Company to supply current.

The Aimwell School building had been torn down, the cellar for the new building practically dug, and good progress was being made.

Committee on Library reported a number of accessions to the library.

Committee on Museum and Herbarium reported that the Bartram reprints were framed and were being hung in the museum.

Special Finance Committee reported further in securing funds for the new laboratory building.

Committee on Instruction reported some details of the rules governing students who had taken instruction in other institutions.

Mr. W. A. Rumsey was appointed chairman of the Committee on Commencement, and Joseph W. England to succeed Mr. James T. Shinn, deceased.

C. A. WEIDEMANN, M.D.,
Recording Secretary.